Potomac Basin
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R. Lacouture

Foam covers the Potomac River in a miles-wide patch in the vicinity of Mattawoman Creek. Located just downstream of a thick blue-green algae bloom, the foam is thought to be caused as the algae die and decompose.

The Greening of the Potomac

Algae Blooms in Potomac Reminiscent of 1980s

Many areas of the Potomac River grew greener this summer. Rather than a testament to improved environmental management, the term describes the bright green shade of algae blooms, the likes of which have not been seen in parts of the river since the mid-1980s. Algal blooms can block sunlight from reaching aquatic plants, while some types actually cover plants. When large blooms die off, their decomposition can strip water of dissolved oxygen, creating areas of poor water quality that are avoided by fish and kill shellfish and other organisms that cannot escape.

After a long absence, the return of large blooms of potentially harmful blue-green algae to the tidal Potomac is an unwelcome sign that much remains to be done to restore the Potomac River and the Chesapeake Bay. Data collected by the Maryland Department of Natural Resources (DNR) and the Estuarine Research Center of Morgan State University (formerly of the Academy of Natural Sciences) have revealed extremely high levels of blue-green algae in the tidal Potomac, with areas of greatest concentration in the river segment from Gunston Cove, Va., past Mattawoman Creek (where the highest concentrations have been found) to about 10 miles south of Quantico. Some of the most recent surveys registered levels of the blue-green algae, *Microsystis*, that can produce toxins that could be harmful to fish or humans that come in contact with it.

The basic reason for the river's condition this summer, and for algae blooms in general, is simple. Nutrient levels in the river are too high, and algal populations are feeding and reproducing off the nutrient smorgasbord. The nutrient concentrations are the result of two years of wet weather and persistent high flows that have loaded the river from urban/suburban runoff, agricultural runoff, and wastewater discharges. Nutrient levels are just a basic ingredient, however, and researchers agree that the reasons for the resurgence after a

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long absence are complex and defy a simple explanation.

Looking at models that attempt to predict conditions needed for an algae bloom, Richard Lacouture, a principal investigator for the Academy of Natural Sciences Estuarine Research Center, was surprised by what he saw on the river. Based on models, and supplemented by his own long experience researching algae, he noted that conditions to bring about a bloom were more likely to be characterized by a wet spring and a hot, dry, low-flow summer that would keep the nutrients available. "If I was a betting man," Lacouture said, "I would give 10-1 odds that there wouldn't have been a bloom this season."

Lacouture has a lot of experience to call on. In describing this year's algae levels, he noted the current conditions as being at least near the levels he observed when he began his career on the Potomac in 1984. Remembering his first day on the river in August 1984, the water was "a color I'd never seen before–almost a fluorescent green. The monitoring trip that day covered the same area as this year's bloom, and "It was like 20 miles of bright green paint on the surface," Lacouture said.

In subsequent years, the river cleared dramatically, and stayed that way through the 1990s. "In the early 1990s," Lacouture said, "I was hard-pressed to find much *Microsystis*." He found minor densities in the late 1990s.

During that decade, there were other years when high flows carried large amounts of nutrients into the tidal river without heavy algal blooms appearing, meaning that other factors must be in play this summer. These factors also must come into play in a certain order, just as a recipe works only when the ingredients are combined in a particular sequence. This summer, the timing of the ingredients and how they were "cooked" seems to have been very important.

The spring was unusual, Lacouture noted, because of a very warm spell of weather in May that heated the river water very quickly, providing optimal conditions for an algae bloom very early in the season. In a more-normal spring when water temperatures are still cool but warming, a different type of algae called diatoms are busy consuming nutrients, before the blue-green algae become active. The rapid warming of the river may have limited the activity of the diatoms prematurely and left large amounts of nutrients available for the blue-green algae to consume. The idea explains the early onset of the blue-green algae bloom, which began just after the warm-up, when it normally would occur in late June or early July, Lacouture said. The early, heavy blooms of *Microsystis* grew to the point of causing the closure of the waterfront at Colonial Beach, Va., for

several days in June. “I don’t recall that ever happening before,” said Kirby Carpenter, the executive secretary for the Potomac River Fisheries Commission, headquartered in the town. Carpenter was not aware of any fish kills or other impacts related to the *Microsystis* bloom.

Peter Tango, in charge of phytoplankton monitoring for the Maryland Department of Natural Resources, and who works closely with Lacouture, agreed that the reasons for a bloom occurring this year were hard to pinpoint, but that an answer would be sought. “The system is very complex,” Tango said, but he is anxious to take a long, hard look at data from the event. “I really want to find out what happened out there,” he said.

Tango added that the most recent monitoring trips have shown that the blooms may be beginning to die off for the season. In late August, some of the green surface scum of the algae bloom was accompanied by a large area of white foam near Maryland Point, downstream of the major concentration, which in late August extended from the Point to Mattawoman Creek. During monitoring, Lacouture found the foam slick concentrated in a two-mile river segment that ran from shore to shore, appearing to be the result of the decomposition of algae.

As the bloom dies, it could create regions of oxygen-starved water in the river, although as with the bloom itself, environmental conditions will have much influence on the extent of any problems, Tango noted. Ironically, the type of rains and high flows that deposited the algae-sustaining concentrations of nutrients in the spring may be just what is needed this fall. High flows could help disperse the decomposing algal mass, spreading the oxygen demand from the decay over a larger volume of water. Water temperature, mixing, and flows can all affect the impact of the die-off, according to Tango.

Of course, those high flows can carry nutrients that could provide the fuel for a potential recurrence next year. Tango does not see a recurrence as a given, but noted that if a similar range of factors recurs, so could a bloom. No one in the research community feels that they have enough data or understanding of the complex system to make predictions.

Even less is known about the algae blooms occurring on the nontidal Potomac River. Observations by anglers, boaters, and other river users have been frequent. Ken Penrod, a professional bass guide who spends more than 100 days on the tidal and nontidal Potomac each year since 1980, noted that the blue-green blooms from the Occoquon River south to the Route 301 Bridge, near Colonial Beach, “are as prolific as I’ve ever seen. The water looks like a giant lawn.” He described the algae bloom on the nontidal Potomac as so bad that he can’t crank a lure through the water without it returning fouled. After the water in the section from Brunswick, Md., to Great Falls cleared from the sediment carried in the spring, he began to see algae suspended in the water column, and described the bloom as green, slimy filaments. He has avoided the main river, favoring some of the embayments and other areas not as impacted. Penrod said that he gets about a dozen emails each week from anglers bemoaning the river’s state.

Several upper river tributaries, such as Conococheague and Antietam creeks, have had noticeably higher levels of sediment this year, noted DNR Fisheries Manager Ed Enamait. He added that submerged vegetation in the river got a slow start because of the water’s cloudiness, and are fewer in number and reduced in growth. While Enamait acknowledges the effects of climate and rainfall in producing the bloom, “I feel that something else is going on,” he said, “This is not normal.” Enamait added that improved watershed management in some areas is needed to reduce sediment and nutrient loads. Enamait also has been looking at some area reservoirs and noting unusual algae blooms. He cited Prettyboy Reservoir on the Patuxent River as a relatively pristine waterbody experiencing an unusual thick algae bloom this year as an example. “I had a hard time believing what I was seeing,” he said.

Paul Miller, responsible for analyzing DNR data collected in non-tidal rivers, has met with the tidal researchers to discuss the upper river. The group is currently examining water quality data from 1985-2002, and comparing it with data collected in 2003 and 2004. In examining nitrogen, phosphorus, and suspended solids concentrations and trends, they are hoping to find a smoking gun to explain the blooms. Algae levels are not monitored in all portions of the non-tidal Potomac. “A lot of the freshwater data collection is done with an eye toward Chesapeake Bay Program goals,” Miller said. “We would like to do more further upstream, but resources are a problem,” he said.

In the early 1980s, the ICPRB was given words of wisdom by Dr. Abel Wolman, of Johns Hopkins University, and recognized as the father of modern water treatment. He cautioned that algae was a part of the natural system, and that the Potomac would never be completely free of blooms. He did

believe that they would be greatly decreased with proper management, a lesson we still need to take to heart today.

Efforts to restore the Chesapeake Bay, with the work focused on improving the health of its tributaries (of which the Potomac is second-largest) began in earnest about the same time that algae blooms in the tidal Potomac began to disappear. Much has been accomplished during that time in a cooperative effort among the federal government through the U.S. Environmental Protection Agency and its Chesapeake Bay Program, the bay watershed states, local governments, citizens, and private groups. While the effort has made observable gains, they may have been gobbled up by population growth, land-use change and the increases in pollution that come with them. "Meeting the goals [2010 nutrient reduction goals] will be difficult," said Chris Connor, a spokesman for the Chesapeake Bay Program. "We must reduce nutrients by about twice as much since coordinated efforts began in 1985," he said.

The DNR posts harmful algae bloom information on its website. Visit http://www.dnr.state.md.us/bay/hab/index.html. More information about nutrients, sediment, and reduction efforts, as well as on tributary strategies for the Potomac and other bay watersheds are available at www.chesapeakebay.net.

2004 Potomac River Sojourn

A Paddle on the Wild Side

Jennifer Dotson, communications specialist at ICPRB and avid kayaker, participated in this year's sojourn as a safety boater. The two guides and about ten other safety boaters kept sojourners safe on the water by assisting with flipped boats, routing sojourners around obstacles, scouting take-out locations, and giving paddling pointers.

G. Coat

Sojourners rest at the toll bridge at Oldtown, Md.

As the cool night air settled in Cumberland, Md., and trains roared through town, 85 sojourners rested in their tents before the first day's paddle on the North Branch Potomac River. For eight days, I would share a river journey with this group of sojourners--an assortment of anxious children, teens, adults, and spry retirees. Having only paddled one day of the Potomac River Sojourn in 2003, I was not sure what to expect from a whole week of paddling in a remote area with such a diverse group of people.

Bringing together citizens of all ages and walks of life, the Potomac River Sojourn is a week-long canoeing and kayaking expedition filled with wildlife sightings, regional history and geology snippets, and camaraderie between river-oriented souls. The main goal of the sojourn is to build constituencies and increase stewardship of the river.

Stewardship is not only about teaching people to care for the Potomac, but also understanding the goals and needs of its communities. Throughout the sojourn, local delegates visited campsites and lunch stops to share the history of their towns and how their citizens use and appreciate the river. Cumberland Mayor Lee Fiedler spoke about how the citizens of the town now view the North Branch Potomac as a valuable recreational resource–a big change from the polluted wasteland it once was. He said at one time, "the citizens turned their backs on the river. But now, they have embraced it again."

With the encouraging send-off on July 9 from Mayor Fiedler and safety instruction from our trip leader, Eric Vance of River and Trail Outfitters, we launched our boats and floated our first few miles. Leaving Cumberland behind us, we headed to Spring Gap, our first overnight stop.

With our group were 16 teens from Digital Harbor High School in Baltimore, Md. Through grant assistance, Baltimore Inner City Outings was able to pay all expenses for them. Brian Green of Baltimore Inner City Outings, said "When we first got up there, they [the teens] didn't know what to expect, especially paddling on the water all day for several days." The group had some difficulties paddling the first day--lagging behind, turning circles, and running into rocks--but after a short evening kayaking lesson focusing on communication, they paddled circles around everyone else.

Sojourners are expected to be able to swim, but some had never been in a canoe or kayak before the trip. The sojourn provided an opportunity to learn about the river while having fun. Many of the more-experienced paddlers often helped novices paddle more efficiently and offered rescues when needed. In our first days, some kayaks and canoes, other than the Baltimore City kids, got hung on rocks or spilled their

contents, including sojourners, causing a traffic jam for the flotilla behind them. Some people were agitated at being stuck, others simply laughed and got back in their boats. The unplanned traffic jams and wet exits brought out the best in the safety boaters. They used these moments as teaching tools to help sojourners become better paddlers. Much of the river conservation message, equally important to the sojourn experience, was absorbed on land, during meals or rest stops.

Each day's programs were planned from early morning until evening, and most sojourners appreciated the preparation and flow of activities. Paul Perjman, paddling the entire sojourn with his son Petri, said "I enjoy having someone else guiding me and telling me about the river. I also like that there is a schedule, but we are still able to enjoy ourselves." Afternoon and evening program topics ranged from geology and acid mine drainage to the history of the Paw Paw tunnel and settlement of western Maryland.

At the beginning of our trip, we paddled on the North Branch Potomac, beginning just below Cumberland. This portion of the river looked quite healthy with vegetated banks, clear water, and an abundance of fish. Just 20 years ago, the legacy of coal mining had left the North Branch Potomac devoid of life. Today, it is a high quality trout stream and whitewater playground. This change came after the creation of Jennings Randolph Reservoir, which greatly lowered acidity in the river downstream. The installation of lime dosers to raise the water's pH have provided additional help. Gary Fuhrman, representing Western Maryland Resource Conservation and Development, spoke about acid mine drainage (AMD) from the Kempton Mine Complex. The complex is the largest single source of AMD, which it deposits into the North Branch Potomac from Laurel Run and other tributaries. There are about 400 abandoned mines in Maryland, many of them near the North Branch. Fuhrman explained that during World War I, all the mined coal was sent to Baltimore to fuel ships, but today water has flooded those now-abandoned mine shafts. Jennings Randolph Reservoir has improved water quality by impounding water of differing acidities from several tributaries. The water is allowed to stratify and is then pulled from the lake at different depths, which neutralizes the water's pH. Water discharged into the North Branch is nearly neutral in pH and healthy for aquatic life. The ICPRB played a major role in the installation of the first two lime dosers and several passive systems in partnership with Maryland Department of the Environment. The ICPRB also coordinates water supply releases from Jennings Randolph Reservoir for the metro region through its Section for Cooperative Water Supply Operations on the Potomac (CO-OP). Continuing efforts to curb AMD are improving water quality in many of the creeks and streams of the watershed.

Even before the coal mines opened, the Potomac was an important transportation and trading route in the region. The watershed's role in furthering the nation's western bounds began in the 1700s with Thomas Cresap's visionary road that connected the mouth of Will's Creek in Cumberland, Md., to Monongahela, Pa. On our paddle from Spring Gap to Paw Paw, we stopped for lunch to take a tour of Cresap's house and the abandoned Shawnese village he settled, now known as Oldtown, Md. Jilla Smith, owner of Cresap House, took us through the house and explained the history of Cresap and how he came to settle Oldtown. The house is filled with native American tools and 1700s furniture, many donated from local residents. Pennsylvania Department of Environmental Protection Watershed Coordinator Mark Dubin dressed in period garb and gave a fascinating presentation about the French and Indian War and the importance it had on Cumberland, Oldtown, and neighboring towns in Maryland. It was amazing to think that the nation's pioneers floated on this same river and walked on this same ground.

After a long lunch stop filled with history, it was time to paddle the remaining 12 miles to the Paw Paw Campground. This section of the river offered more of a challenge for some boaters with its larger riffles and narrower girth. Some paddlers opted to take out at Oldtown, and others at Town Creek, six miles before the Paw Paw Campground. I stuck with the remainder of the group to finish the 18.5-mile paddle to the campground. This section threw us a hairy "Z" turn that required some maneuvering, a skill that is difficult to master in sea kayaks and long canoes. Every boat glided through the rapid with ease like colorful marching ants. I was impressed. Most of us had some experience on the water and with the smaller group, we had fewer traffic jams and made great time.

During this stretch, I noticed a different vibe from the group. These remaining die-hard paddlers were intent on completing the long day so there were very few squirt gun fights and conversations seemed quieter. Of course, our number one squirt gunner had taken out earlier in the day. We enjoyed the steep, tree-lined banks, the occasional fisherman, and the flight of a bald eagle.

As soon as we reached the day's take-out, campsites were buzzing with people, tents, gear hanging to dry, and talk of the night's program--the geology of the Paw Paw Bends. Stan Dickinson, a volunteer with the C & O Canal National Historical Park, spoke about the geology of the

Potomac at Paw Paw Bends and Paw Paw Tunnel. This section of river twists and turns through the valley with spectacular rock outcroppings and cliff faces. A part of the C&O Canal infrastructure, the 3,000-foot tunnel cut a straight swath along side the bending river, shortening the trip by about five miles. To build the tunnel, crews drilled the mountain from both sides and from the top to complete the task. Fourteen years after initial groundbreaking, the tunnel was completed. We sojourners would be paddling through all the twists and turns of the Paw Paw Bends, happy to experience the beautiful scenery.

After a long day of paddling, there is nothing better than live music. The string band *Our Wives Think We're Working* began playing at dusk. Sojourners relaxed at the picnic tables, in tents, and chairs while listening to the traditional folk music. This simple music--string instruments, foot tapping, and singing--brought a sense of calm to the night. Don Shapelle, a traditional folk singer who focuses his song-writing on the Chesapeake, entertained us later in the week. Campsites went quiet and dark, except for the music, crickets, and firefly light shows.

When there is no live music, ghost stories are the next best option. After our evening of live music and another day of paddling, we enjoyed learning about Green Ridge State Forest and its ghosts from Francis Zumbrun and Alicia Norris of Green Ridge State Forest in Allegheny County, Md. Norris told us about the ghost town, Green Ridge Station, about 200 yards up the road from our campsite and the various graveyards and ruins throughout the forest. Zumbrun explained that the forest was once clearcut, but is now a sustainably managed stand of timber. He explained that the area used to be an apple orchard, but was then acquired by the state for conservation. Allegheny is the driest county in Md., receiving only 20 inches of rain per year, and is so dry that the Maryland native prickly pear cactus grows throughout the area. "The forest is resilient," said Zumbrun and on our paddle the next day, we were able to enjoy Green Ridge from the river and appreciate its importance as recovering forest.

By this time in the journey, sojourners had bonded with one another and the river. It was amazing to see the group playfully compete in squirt battles, races, and swimming. The sojourn experience can be addictive because of the bonds formed with others and the river. Rick Shumaker, one of the sojourn's safety boaters, proudly said, "I don't know how many sojourns I've been on. I go on as many as my vacation days will allow." Shumaker is a regular on the Susquehanna Sojourn and has been going since they began 13 years ago. Shumaker feels that teaching people about conserving the river and the river's impact on our lives is the most important message to gain from the sojourn experience.

When asked if she would do it again, first-time sojourner, Nancy Hendrick said, "It was tremendous! I'd definitely do it again." Many of this year's sojourners were veterans and will be back for another week in 2005 to enjoy a different section of the Potomac.

The Potomac has endured many changes over the last century and has also proven to be resilient. Through our paddles, we noticed several small creeks discharging muddy water into the Potomac after the previous night's rain. Sediment pollution is one problem plaguing the Potomac. Nutrient pollution from farms and lawns is another major issue throughout the basin. The North Branch Potomac, where we began our sojourn, showed very few signs of stress, an amazing comeback after it's battle with AMD. The Potomac will continue to improve with the efforts of conservation-minded citizens like those on the Potomac River Sojourn.

Stored Water Releases for Supply Unlikely

With this year's above-normal precipitation, there is a one- to three-percent chance that water supply releases from Jennings Randolph and Little Seneca reservoirs will be needed to supplement current flows, according to the ICPRB Section for Cooperative Water Supply Operations on the Potomac (CO-OP). The CO-OP works with the Washington metropolitan area water supply utilities to ensure that adequate drinking water supplies are available even during times of extreme drought.

On average, there is a 10- to 16-percent chance that water stored in reservoirs will be needed to augment Potomac flows during the late summer and fall, when river flows generally are lowest. In years when actual releases of stored water are not needed to augment supply, CO-OP and the water suppliers annually engage in a simulated "drought exercise" to practice and refine drought operations.

For more information on current water supply status, the drought exercise, and the water supply system for the metropolitan area visit the ICPRB website at www.potomacriver.org. (Follow the appropriate links under "water supply.")

Watching the River Flow

Waterways are flowing higher than average for the season after above-normal precipitation throughout the Potomac basin increased stream and river levels, according to the U.S. Geological Survey.

Provisional data collected near Washington, D.C., for June showed the river's flow well above normal at an average of about 7.9 billion gallons per day (bgd), 132 percent of the historical average of 6.0 bgd. Though above normal, river levels are still following their seasonal downward trend. Daily extremes ranged from a low of about 3.8 bgd on June 30 to a high of about 18.1 bgd on June 6. Water withdrawn for drinking use averaged about 424 million gallons per day (mgd), about nine percent more than in June 2003. Freshwater inflow to the Chesapeake Bay averaged about 42.2 bgd, four percent above the historical average. The Potomac contributed about 23 percent of the total.

Above normal precipitation in July caused several streams in the basin to flood. July flows were about 3.6 bgd, slightly higher than the normal of about 3.2 bgd, or 111 percent of the normal flow. Flows ranged from a low of about 2.9 bgd on July 22 to a high of about 5.6 bgd on July 8. Water withdrawn for drinking use averaged about 482 mgd, about 15 percent more than May 2003. Freshwater inflow to the Chesapeake Bay averaged about 37 bgd, about 52 percent above the normal flow. The Potomac contributed a meager 13 percent of the total flow.

The USGS has been collecting streamflow data for more than 100 years. Streamflow and groundwater data are used to assess water conditions and can be used to predict the potential for flooding and drought, as well as for recreational purposes. Stream gages are chronically underfunded and some in the Potomac basin are in danger of being shut down.

USGS, ICPRB Launch Real-time Groundwater Webpage

Real-time groundwater monitoring information for the Potomac basin is now available online. A website maintained by the U.S. Geological Survey (USGS) is part of a comprehensive groundwater study of the basin undertaken by USGS and the Interstate Commission on the Potomac River Basin (ICPRB).

The site features monitoring information from 19 observation wells in the watershed that are outfitted to transmit groundwater level data via satellite, bringing immediate information to researchers and decision makers.

The new website is a tool in a project designed to provide information to assist local governments and managers to better understand and manage water resources in the Potomac River basin. This information is especially valuable during drought periods.

The real-time data collection allows researchers to understand the dynamics of water resources in the basin and helps water managers to meet future demands. With rapid growth occurring in the basin, evaluating the impacts of new groundwater withdrawals is essential to managing water resources in a way that will ensure adequate groundwater recovery and water supply for domestic use, recreation, and industry while protecting aquatic habitat. A study conducted in 2000 by the Interstate Commission on the Potomac River Basin (ICPRB) for the Maryland Department of the Environment forecast that by 2030, consumptive water use in two Potomac sub-basins (Monocacy River and Middle Potomac River/Catoctin Creek) could exceed available supply in the event of a recurrence of historical low-flow conditions.

"There is much to learn regarding the basin's groundwater resources, their volume, and response to drought conditions," noted ICPRB Executive director Joseph Hoffman. "We are grateful that Congress and the Department of the Interior have funded this basinwide effort to obtain information necessary to responsibly manage our single water resource, whether from the surface or the ground. As demand for water continues to grow, we need more information and new ideas to provide water while protecting and preserving the Potomac's other resources," Hoffman said.

To obtain real-time groundwater data, visit *http://pa.water.usgs.gov/potomac.*

To learn more about the site and other USGS initiatives about groundwater, contact Dennis Risser, USGS Pennsylvania District; (717) 730-6911 or email at dwrisser@usgs.gov.

Potomac Stewards Pass Away

The Potomac basin recently lost two people whose long, strong support for river conservation improved the status of the watershed and the lives of its residents.

Robert Schueler died on July 28. The 83-year-old biologist capped off a long professional career with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service by giving selflessly of his time as a member of Trout Unlimited and the local chapter of the American Fisheries Society.

Schueler assisted with conservation efforts in the Anacostia watershed in the 1980s, and worked with members of many local and regional government agencies, as well as with Trout Unlimited and other citizens groups. He was a champion in protecting Paint Branch, an Anacostia tributary that holds the only naturally reproducing trout population in the metropolitan area.

Douglas Faris, who recently retired as superintendent of the C&O Canal National Historical Park, died on July 9.

His career as a planner and National Park Service employee was capped by

nine years as the superintendent at the park (see September/October 2003 *Reporter*). He was cited for his strong stewardship of the park, which included greatly increasing government and volunteer support. Faris is credited with bringing increased support for the park after it was severely damaged during the floods in 1996. Faris also worked closely with local river communities along the park to increase and coordinate conservation for both historical and environmental goals.

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